Increasing healthcare costs: can we influence the costs of glaucoma care?

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Abstract: PURPOSE OF REVIEW Despite a decrease in real average growth rates per capita since 2009, healthcare costs continue to rise worldwide. Numerous patient-related and doctor-related factors have contributed to this rise. Glaucoma is the leading cause of irreversible blindness and requires chronic, usually lifelong treatment. As with other chronic diseases, the adherence to prescribed treatment is often low and maybe influenced by the cost of the therapy. The purpose of this review is to seek potential solutions to best control the escalating costs of glaucoma care. RECENT FINDINGS The studies we selected for this review can be divided into four different categories: costs of diagnostic tests; costs of direct comparisons between drugs or laser and conventional surgery; patient-related factors (such as adherence); and general aspects regarding costs: theoretical models and calculations. SUMMARY It is challenging to find reliable studies concerning this subject matter. As patients are under the umbrellas of variously organized healthcare systems which span different cultures, the costs between countries are difficult to compare. However, one common aspect to lower costs in glaucoma care is to improve patient adherence. Theoretical models with actual patient studies could enable cost reductions by comparing multiple diagnostic and therapeutic scenarios. VIDEO ABSTRACT: http://links.lww.com/COOP/A22.

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Increasing healthcare costs: can we influence the costs of glaucoma care?

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Video abstract
http://links.lww.com/COOP/A22.

Keywords
adherence, compliance, costs, glaucoma care, healthcare

INTRODUCTION

When reviewing overall healthcare costs worldwide, two sources of statistics are most often cited: the Organization for Economic Cooperation and Development (OECD) and the World Health Organization (WHO).

The OECD compares data of 34 industrialized countries. The total costs of healthcare can be presented as a percentage of the gross domestic product (GDP; measure of the total economy of a nation) or as expenditures per capita. Eighteen percent of the world population lives in countries belonging to the OECD. The average health spending as a share of GDP of the OECD countries was 8.9% (2013) and the average per capita expenditure was US$3453 (2012) [1].

The WHO presented the figures of 2012 in a global overview [2]. The total global expenditures for health were US$6.5 trillion with a per capita expenditure of US$948 per year with a significant discrepancy between the country with the lowest spending (Eritrea: US$12) and the highest (United States of America: US$8362).

Since 2009, and in part because of economic crises, average healthcare costs have steadily increased worldwide despite a decrease of the real average growth rates per capita. Numerous causes exist on both, the patient's and doctor's sides, contributing to these rising healthcare costs.

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KEY POINTS

- Comparing healthcare costs in different countries is challenging because of wide ranges of reimbursement models, amounts, and insurance systems.
- Typically, studies are focused solely on comparing two different treatment modalities, for example lasers vs. medications or conventional surgery vs. medications. Direct, indirect, and quality of life costs are seldom included. Furthermore, the studies compiled do not use a standardized protocol.
- The combination of a growing elderly population with an increasing number of glaucoma patients combined with general financial limitations of healthcare systems require well-designed studies to optimize glaucoma treatment so that cost–effectiveness may ultimately be determined.

Both average age and individuals' expectations are growing, and their overall health is better than in previous years. In addition, there are better diagnostic means and treatment options available. The combination of these factors leads to an increase in total healthcare costs.

Glaucoma is the leading cause of irreversible blindness worldwide and its prevalence is rising [3,4]. It is estimated that in the year 2020, 80 million patients will be affected by the disease [4]. In addition, other estimates contend that at least 50% of all patients do not know that the disease affects them [5]. Glaucoma creates direct costs as well as indirect costs. The direct costs include expenses for diagnostic tests and therapy, whereas indirect costs have several sources: costs for the individuals taking care of glaucoma patients; and alternatively costs for consecutive problems (e.g., depression triggered by the diagnosis, increased incidence of falls, and inability to drive).

Considering increasingly limited healthcare budgets, greater solutions will be mandatory to reduce costs for the management of our glaucoma patients. The goal of this review is to review current publications related to these issues.

METHODS

A literature search was conducted using MEDLINE and http://www.google.com on August 18th 2016. Search strings were 'glaucoma' and 'costs'. Forty-two articles were found on MEDLINE published between January 2015 and July 2016. Manuscripts, which were not written in English ($n = 2$), were excluded. From the remaining 40 publications screened, 16 manuscripts were selected which contained information on glaucoma and related healthcare costs.

COSTS OF DIAGNOSTIC TESTS

Heidelberg retinal tomography II vs. glaucoma diagnostics in diagnosing glaucoma

Mokhtari-Payam [6] *et al.* performed an analysis on cost–effectiveness of Heidelberg retinal tomography (HRT) II vs. glaucoma diagnostics (GDx) for diagnosing glaucoma in Iran. The study compared costs of one hospital using HRT and a second hospital using GDx. The authors came to the conclusion that 'HRT II provided diagnostic accuracy at a lower cost than GDx'. [6].

Tele-glaucoma screening

Thomas *et al.* [7▪] compared costs and physician time for teleglaucoma screening in rural Canada compared with in-person visits. They found teleglaucoma screening to reduce costs, increase access to ophthalmic care, and improve healthcare service efficiency, specifically in rural areas [7▪]. Thus, teleglaucoma screening could reduce cost and effectively improve the quality of life.

Automated imaging technologies for the diagnosis: the Glaucoma Automated Tests Evaluation (GATE) study

Azuara-Blanco *et al.* [8] focused on this topic for the National Institute for Health Research in Great Britain. Their report compared diagnostic performance and cost–effectiveness of imaging technologies as triage composite test for identifying people with glaucoma [8]. The triage tests included: first, imaging with HRT, using glaucoma probability score (HRT-GPS) and Moorfields regression analysis (HRT-MRA), second, scanning laser polarimetry GDx, and third, optical coherence tomography (OCT). The comparator was a triage test with a clinical examination performed by a glaucoma specialist plus visual field testing and intraocular pressure (IOP) measurement. They noted two findings: first, automated imaging can be effective as an aid to diagnose glaucoma among individuals referred from the community to hospital eye clinics and second, a model of care using a triage composite test appears to be cost effective [8].

COSTS OF DIRECT COMPARISONS BETWEEN DRUGS OR LASER AND CONVENTIONAL SURGERY

Laser trabeculoplasty vs. medical treatment

Schultz *et al.* [9▪] compared short-term costs of laser trabeculoplasty (4743 patients) and medication

management (16 484 patients) for open-angle glaucoma in the USA (commercial insurance and Medicare supplemental insurance beneficiaries). The group identified poor adherence, younger age, and more comorbidities as predictors of receiving laser trabeculoplasty. Medication use was reduced after laser trabeculoplasty. However, they did not identify cost savings by laser trabeculoplasty compared with medical treatment. Furthermore, laser trabeculoplasty may not be advantageous in resolving poor medication adherence, given that the majority of patients (80%) require supplementary treatment with topical drops within 2 years of treatment.

Generic and branded glaucoma drops

Queen *et al.* [10] evaluated discrepancies in doses per bottle, bottle fill volume, and cost among branded and generic formulations of latanoprost in Texas, USA. Annual cost and number of doses per bottle (factors important to patients) vary significantly depending on the manufacturer of the latanoprost [10].

Surgery vs. medical treatment

Kaplan *et al.* [11] compared cost–effectiveness of Baerveldt glaucoma implants, trabeculectomy with Mitomycin C, and medical treatment. Trabeculectomy and the Baerveldt implant are cost effective compared with medical treatment alone, but require the willingness to pay US$50 000 per quality-adjusted life-years (QALYs). However, trabeculectomy is at a substantially lower cost per QALY compared with the Baerveldt implant.

Cost–effectiveness of cataract surgery in advanced glaucoma

A study from Shanghai, China prospectively reviewed cost–effectiveness of cataract surgery in advanced glaucoma [12]. The follow-up was limited to 3 months. They concluded that cataract surgery is highly cost effective in these patients and helped to obtain more QALYs [12]. Nevertheless, the study is based on short-term data only. It is well known that the IOP-lowering efficacy of cataract surgery alone is time limited. Considering that, the study results could be quite different were longer-term results compared.

Cost–effectiveness of combined cataract surgery + iStent implantation

A 3-year study from Manchester, United Kingdom compared costs of surgery vs. costs of continuation of medical glaucoma treatment [13]. The cost–effectiveness varied depending on whether brand or generic eye drops were used. Combined Phaco + iStent was only cost effective when generic medication was used as a comparator.

Fixed-combination drugs

An Indian study looked at combination of drugs in primary open-angle glaucoma [14]. Combinations of Dorzolamide plus Timolol, Brimonidine plus Timolol, and Latanoprost plus Timolol were compared. Brimonidine plus Timolol was found to be most cost effective among three groups [14].

PATIENT RELATED FACTORS (SUCH AS ADHERENCE)

Influence of Medicare Part D prescription drug benefit on nonadherence in the United States

A study by Blumberg *et al.* [15] aimed 'to determine whether the implementation of the Medicare Part D prescription drug benefit affected rates of cost-related nonadherence and cost-reduction strategies in Medicare beneficiaries with and without glaucoma and to evaluate associated risk factors for such nonadherence'. Switching to another Medicare plan led to reduction of cost-reduction strategies. The study identified the following factors for nonadherence: female gender, younger age, lower income, self-reported visual disability, and a smaller Lawton-Index (i.e., geriatric assessment of daily life activities). However, patients reporting failure to fill prescriptions because of cost remained stable [15].

Influence of monetary enticement on adherence

A group from Singapore has published a study protocol. The SIGMA study will search for evidence on whether adherence-contingent rebates can improve medication adherence among nonadherent glaucoma patients [16]. Recruitment is currently ongoing.

GENERAL ASPECTS REGARDING COSTS: THEORETICAL MODELS AND CALCULATIONS

Comparison of brand and generic drugs in the United States and Canada

Schlenker *et al.* [17] compared costs of brand and generic drugs in the United States and Canada. The

major finding of this study is that brand drugs are four-times more expensive in the United States compared with Canada, whereas prices for generic drugs are similar between both countries. Furthermore from 2006 to 2013, prices of brand drugs in the United States increased by a greater extent compared with Canada.

Healthcare utilization by glaucoma patients

A group in Taiwan compared healthcare utilization by glaucoma patients and nonglaucoma patients in Taiwan during a 1 year follow-up and compared total healthcare costs of both groups [18]. The study found that two-fold higher total costs were generated by greater healthcare utilization by glaucoma patients.

Cost–effectiveness of treatment of ocular hypertension

This review focused on the cost–effectiveness of treatment for ocular hypertension [19]. The review found contradictory results with no clear answer to the objective of the review. A similar study conducted in the United Kingdom found it adequate to monitor ocular hypertension (OHT) not more often than every 2 years [20]. Alternatively, primary treatment and minimal monitoring were found to be sufficient [20].

Economic burden of childhood glaucoma

This study analyzed costs in the United States of America related to childhood glaucoma during the first 4 years after diagnosis [21▪]. The annual cost of care of childhood glaucoma averaged US$ 21 441 per patient [21▪]. The highest contributors to such costs were surgical interventions and examinations under anesthesia (EUA). Costs were highest in the first year after diagnosis.

Increase of costs because of changes in demographics

Stein published a commentary on the hidden costs and burdens of glaucoma based on Medicare data [22]. He estimated a dramatic increase in costs because of an aging population.

CONCLUSION

There are few studies, which focus on the question of how the costs of glaucoma care could be effectively contained. We divided the studies into four different categories:

(1) Costs of diagnostic tests.
(2) Costs of direct comparisons between drugs or laser and conventional surgery.
(3) Patient related factors (such as adherence).
(4) General aspects regarding costs: theoretical models and calculations.

First, Mokhtari-Payam [6] studied the cost–effectiveness of HRT II vs. GDx in two different hospitals and found that HRT II was more cost effective [6]. Comparing telemedicine with direct patient contact, telemedicine appeared more cost effective and could prevent 24% of blindness after 30 years

Azuara-Blanco [8] compared the diagnostic accuracy, performance as a triage test, and cost–effectiveness of automated imaging technologies. They found that a composite triage test, including imaging, visual acuity, and IOP measurements would be more cost–effective than the current system used.

Second, a US group looked at four different latanoprost formulations (the original Xalatan and three generics) in a comparative economic evaluation [10]. They found that the number of doses per bottle and the annual costs varied. This is in accordance with older studies, in which they found variations in the size of the drop and the size of the bottle opening and the number of drops per bottle. All of these factors influence the monthly cost of a drug.

An Indian study compared three drug combinations, and found that the combination of Brimonidine/Timolol was most cost effective. They calculated cost–effectiveness by cost per mm IOP reduction [14].

Schultz presented a retrospective analysis of laser trabeculoplasty vs. medical treatment. Laser treatment was performed in younger patients with low adherence. The patients receiving a laser treatment used fewer antiglaucoma drugs; however, 80% required additional antiglaucoma drugs 2 years after the laser treatment. The question arose, however, whether the results are significant, given that 48% of the patients they examined were less than 65 years of age (which is not representative of a typical glaucoma population) [9▪].

A Markov model (5-year horizon and 100 000 glaucoma patients) was used to compare trabeculectomy vs. tube shunt surgeries. At the level of US$ 50 000 per QUALY gained, both were cost effective, whereas trabeculectomy was already cost effective at a lower amount of money per QUALY gained [11].

A Chinese study found cataract surgery cost-effective in lowering IOP in advanced glaucoma patients. However, these findings contradict other

studies regarding the IOP-lowering efficacy of cataract surgery [12].

A similar Manchester study came from calculated the cost effectiveness of phaco with a single iStent after 3 years and compared the cost to the cost of antiglaucoma drugs. Their conclusion was that any cost advantage depended soley on the type of drug used (brand vs. generic) [13].

Third, it is well recognized that adherence influences costs of treating glaucoma. Blumberg studied the behavior of patients before and after changes in insurance coverage for medication related to Medicare Plan D and found specific adherence patterns in different patients [15].

Fourth, generic drugs are known to have, in general, a lower price than brand drugs. A Canadian study showed a four-fold higher price for brand drugs than generic drugs. However, they found an interesting result that the US brand drug prices increased at a much greater rate than the Canadian brand drugs during recent years [17].

Glaucoma patients created two-fold higher costs utilizing healthcare facilities than nonglaucoma patients in Taiwan. Outpatient visits and inpatient days were included in these costs [18].

Tuulonen [19] reviewed the cost–effectiveness of monitoring and treating ocular hypertension. They created a simulation model with five different pathways and recommended that confirmed OHT patients need not be monitored more often than every 2 years. As an alternative, they discussed primary treatment with minimal monitoring to assess treatment responsiveness (as measured by IOP). Their conclusions regarding the cost–effectiveness of treating OHT were inconclusive [19].

Liu analyzed the costs of treating childhood glaucoma during the first 4 years after diagnosis. He found that the overall costs were highest during the first year after diagnosis [21▪].

Through analyzing these various published studies, we conclude that there is no single appropriate study design to answer the question of how we can best constrain the costs of glaucoma care while providing effective and adequate care. Furthermore, it is very difficult to compare these studies because of the diversity of the systems as many are based on a particular healthcare reimbursement programme (such as Medicare in the United States), which differ from other programmes to vastly to allow comparison. Additionally, many countries do not have a centralized healthcare system, to enable cost data comparisons.

Following our analysis of these recent publications we conclude that additional studies are necessary to improve our knowledge about costs related to glaucoma care. The rapid growth in number of MIGS procedures performed will add another cost/benefit value in future such analyses. Although, we assume that surgeries when compared with medications or laser trabeculoplasty will likely increase treatment costs in the short-term, these procedures may lower total treatment costs in the long-term, especially when considering adherence issues [23]. However, at the moment, there are no RCTs proving long-term efficacy (i.e., $\geq$3 years) for the majority of the MIGS procedures. To answer this question in the future, long-term data on the efficacy of MIGS procedure with a standardized protocol is needed. In addition, the variety of reimbursement models among different countries creates a challenging barrier to comparing total healthcare costs and this variable is unlikely to be resolvable.

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Conflicts of interest

There are no conflicts of interest.

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Papers of particular interest, published within the annual period of review, have been highlighted as:

- ▪ of special interest
- ▪▪ of outstanding interest

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